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**PROCEEDINGS**

# Mesoscopic Modelling and Optimization of Additive-Manufactured Microlattice Materials for Energy Absorption

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**ABSTRACT**

Additively-manufactured microlattice materials have attracted much attention due to their outstanding mechanical properties and energy absorption capacity. Considering the high cost of 3D printing, numerical simulation has become the most common approach for predicting and optimizing the mechanical performance of micro-lattice materials. The current study provides an efficient method to incorporate the printing process induced geometric defects in the lattice models. Numerical simulations are performed to precisely predict the mechanical response of the printed microlattice materials under quasi-static and dynamic loadings. Furthermore, the microlattice structures are graphically represented based on their mesoscopic structural characteristics. Accordingly, an end-to-end Structure to Sequence Neural Network (Strut2SeqNN) is introduced to model the nonlinear relationship between the spatial features of lattice-based metamaterials and their sequential features in mechanical response. The results can provide further guidance for the optimal design of microlattice materials with high performance.

**KEYWORDS**

Additive manufacture; impact dynamics; numerical simulation; machine learning

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